RICHARD WILLIAM JOLK, P.E., CMA (emeritus), PhD
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SKILLS SUMMARY

A registered professional minerals engineer (mining / extractive / mineral processing metallurgy), and certified minerals appraiser with over 45 years of domestic and international experience. Adept at writing and presentation skills as key attributes of the work. Industry specific capabilities include detailed review of exploration and drill programs, geostatistics and deposit modeling as applied to resource and reserve estimation; development and interpretation of geomechanics and hydrologic testwork programs; development and review of metallurgical testwork programs; mining method selection and mine design; ore processing method selection and plant design; mineral estate valuation / appraisal; project feasibility analysis; environmental permitting and compliance / reclamation / closure operations; and design of most other essential programs associated with mineral property development and operations.
Possess and apply extensive minerals engineering expertise to evaluate and further develop mineral projects. Skilled at capital budgeting by congruently evaluating multiple deposits at various stages of development thereby determining the type and amount of work to be performed on one or multiple projects so as to maximize portfolio value.
Strengths include the ability to select an appropriate and most favorable mining method and processing scenario using fundamental mineral deposit parameters (deposit type, depth, size, shape, ore and host rock characteristics, mineralogies, local hydrology), results from which allow mine development plans to advance. Capable of selecting and further developing an appropriate processing scenario from fundamental metallurgical parameters when only ore mineralogy is known and little to no testwork is yet available.
Ability to formulate infrastructure and logistics requirements for project plans and schedules including consideration of location, climate, access, and the availability of power, water, and human resources.
Expertise in developing pro-forma income statements based on estimated mine production revenue in conjunction with capital and operating costs scheduled for the project development plans. Skilled at comparing enabling vs enhancing technologies considered during project valuation. Have supported evaluation and project advancements of both greenfield and brownfield projects. Proficient in use of Microsoft Excel, Word, Power Point and Project, Oracle Crystal Ball, and earlier versions of AutoCAD.

EXPERIENCE SUMMARY

Commonly required to advance mineral development projects (both greenfields and brownfields), located in distant lands and in difficult conditions where success is derived through collaborative teamwork by many groups, each with different cultures and measurements of achievement. Have performed work both for an owner and as an owners representative. Experience has included EPC / EPCM design build, mineral estate valuation / appraisal, arbitration / litigation support and owners representation. Experienced with environmental permitting and compliance through closure, including consideration of acid rock generation, waste rock blending, concurrent reclamation and costs associated therwith.
Involvement at all levels of mineral engineering, project valuation, and operations including projects for Freeport MacMoRans' Climax Molybdenum, Irian Jaya, Bagdad, and Tahono Mines; Rosario Resources' Pueblo Viejo Mine; Newmonts' Yanacocha and Batu Hijau Mines; Groupo Mexicos' Cananea Mine; Gold Reserves' Brisas del Cuyuni Project; Essers' Minnesota Steel Complex; and Lion Copper and Gold Corps, Yerington Property; CSM Mining, Milford, Utah property; Minnesota Dept. Natl. Resources, Regulation Development.
Assembled a team and testified before a World Bank ICSID tribunal (Washington, D.C.). Provided testimony for the US District Court of Appeals (Reno, Nevada), in the US District Court (Los Angeles, CA), and for both regional and international arbitration boards.
Have prepared and chronicled multiple due diligence investigations for mine operators, insurance firms and public sector markets as a "qualified person" within the bounds of the Canadian Stock Exchange National Instrument 43-101 reporting standards.

PROFESSIONAL AFFILIATIONS

Society of Mining Engineers
International Institute of Mineral Appraisers
Association for the Advancement of Cost Engineering International
Project Management Institute

CERTIFICATION

Registered Professional Engineer	Colorado PE #24448 (active)	Nevada PE #8835 Arizona PE #25360
	Montana PE #11345	Utah PE #94-269865-2202
Certified Mineral Appraiser	2010 – 01 (emeritus)	
		MSHA Surface Trainer Previous DOD clearance

EDUCATION

Colorado School of Mines	PhD '07 – Mining and Earth Systems Engineering – Environmental Minor
	MS '93 -- Environmental Engineering – Reclamation /Water /Wastewater
	EM '86 – Engineer of Mines – Mineral Economics /Mine Valuation
	BS '78 -- Metallurgical Engineering – Extractive /Mineral Processing

FOREIGN LANGUAGES -- Functional German, semi-functional Spanish

EXPERIENCE
Working for Mine Operators at Specific Mining Projects

Climax Molybdenum Co, Shift Boss / Mill Foreman, AMAX, Inc.
Climax, Colorado (December 1979 through August 1983)

Entry level management at the Climax Mine atop Freemont Pass. Work entailed supervising crews on 7-day production shifts (days, swings, graves) supporting a 50,000 ton/day production effort. Operating areas included crushers, mills, the tailings impoundment and ancillary facilities located both on the surface and underground.

AMAX R&D Laboratory, Inc.
Golden, Colorado; Crested Butte, Colorado; Climax, Colorado (January 1979 through December 1979)

Process development metallurgist performing bench and pilot scale tests on ores from existing and newly acquired deposits. Designed, constructed, and operated pilot plants capable of processing 50 tons of raw ore per day employing common comminution and concentration techniques. Pilot investigations included design and implementation of sampling, analytical support and mineralogical investigation of ores and concentrates.

Moose Mine Sulfide Flotation Mill, Mill Superintendent, London Mine Venture, Inc., Boulder Gold Corp.
Alma, Colorado (April 1988 through August 1988)

Mill Superintendent hired to refurbish, recommission, operate and maintain a small sulfide flotation mill in Alma, Colorado. Responsible for operations, maintenance and administration of the process facilities and crew of 16 individuals including budgeting, scheduling, purchasing, equipment refurbishment, plant modification, hiring, operator training, MSHA safety training, industrial hygiene and public relations.

Casino / Winrock, Yankee, Green Springs Alligator Ridge Retrofit Gold Mine Projects, Chief Metallurgist, Project Manager, USMX, Inc.
Lakewood, Colorado, Ely; Nevada; St. George, Utah (August 1989 through June 1994)

Managed metallurgy at the Green Springs, Alligator Ridge, Casino / Winrock, Ely, Nevada; and Goldstrike, St. George, Utah operations. Projects included preparation, implementation, and analyses of heap leaching, rinsing, and detoxification programs. Managed final reclamation and closure at several mine sites and process facilities including the removal of all equipment, burial of remnant fluid management system components, final grading and contouring of roads, pads, and waste dumps, and seeding of the recontoured ground.

Brisas del Cuyuni Polymetallic Project, Vice President - Development, Gold Reserve Corp.
Las Claritas; Puerto Ordaz, Venezuela (May 1996 through February 1998)

Responsible for advancing resource and reserve development and preparation of a bankable feasibility study ultimately leading to project financing and the contracting of an EPCM firm. The location was primitive being near the Yanomami Indians in Southeast Venezuela. Work included management and direction of all on-shore and offshore development activities including human resources, project infrastructure, environmental permitting and compliance, and the identification and qualification of contractors and vendors.

Humecca Uranium Mill, Student Process Engineer, Rio Algom, Inc.
Lisbon Valley, Utah (summers 1977 and 1978)

Two summers, 1977 and 1978, working as a student engineer / plant operator in all crusher and mill areas while backfilling for vacationing operators. Worked as sample bucker, assayer, mill clerk, radiation safety technician, and (interim) radiation safety officer. Developed a fluorometric uranium urinalysis technique for regular use on site as a health-screening tool for mine and mill workers.

Working for Mineral Engineering (EPC / EPCM) Companies at Specific Projects

Colosseum Gold Project, Commissioning Mill Engineer, Minproc (USA), Inc.
Las Vegas, Nevada (April 1987 through March 1988)

Resident metallurgist on site during operational commissioning of the Colosseum gold project located South of Las Vegas, Nevada, on the high Mojave Desert. Finalized installation and trained process personnel to operate the crushing, grinding, leaching, and carbon stripping facilities in efforts to optimize gold extraction and achieve the required cyanide detoxification levels.

EXPERIENCE

Pueblo Viejo, Carbon-in-Leach Gold Mill Conversion, Process Metallurgist / Engineering Manager, Bateman Engineers, Rosario Dominicana S.A.

Santo Domingo; Cotui, Dominican Republic (August 1988 through May 1989)

Process Metallurgist / Engineering Manager working exclusively on the Rosario Dominicana, S.A. – Pueblo Viejo Project. Lead process engineer during process conversion from Merrill-Crowe to carbon-in-leach (CIL) gold extraction. Managed completion of preliminary engineering in Denver, and detail design offshore at Sercitec, S.A. in Santo Domingo.

SXEW Copper Project, Cyprus Tohono, Casa Grande, Arizona, Fluor Daniel Engineering

Golden, Colorado; Casa Grande, Arizona (March 1996 through May 1996)

Process engineer responsible for an on-off pad and process design, copper inventory estimates, and economic analyses for the Cyprus Tohono SXEW copper project. Duties included the development of process design criteria, flowsheets, piping and instrumentation diagrams, site water balances, review of metallurgical data to date, preparation of in-heap gold inventory estimates and identification of environmental issues related to the process metallurgy.

Yanacocha Gold Project, Newmont, Fluor Daniel Engineering

Golden, Colorado; Cajamarca, Peru (February 1995 through March 1996)

Responsible for process engineering of the phase 3 Maqui Maqui – phase 4 Carachugo expansions. Modifications were made to the existing heap leach circuit, Merrill Crowe plant, and wastewater treatment plant to increase process solution throughput, enhance gold recovery, minimize gold inventory, and meet environmental standards. Scope included the generation of overall heap rinse and reclamation plans.

Irian Jaya Copper Project, Freeport MacMoRan, Fluor Daniel Engineering - WSNelson and Company, Inc.

New Orleans, Louisiana (June 1994 through February 1995)

Responsible for process engineering on the Irian Jaya No. 4 concentrator, 176,000 tpd expansion. Duties included the development of process design criteria, flowsheets, mass and energy balances, piping and instrumentation diagrams, site water balances, operability studies, major equipment start-up and shutdown sequences, selection of equipment, and the direction of metallurgical and environmental contractors.

Mineral Engineering, Appraisal, Litigation Support Consulting Services; Mineral Property Development, Inc.

Minerals Engineer / Minerals Appraiser, Founder and Principal

Golden, Colorado; Montrose, Colorado (April 1999 to present)

Perform mine valuations and provide expert opinion / independent review / management consulting to the minerals industry. Services include engineering and design, cost estimation, life cycle cost analyses, risk analyses, proposal preparation and review, project scheduling, budgeting and owner on-site representation as applied to resource development, project permitting, process design, facilities engineering, industrial water / wastewater treatment, process management / control systems, and industrial facilities remediation.
Have been deposed and testified as a mining expert in US Federal Court (Couer vs. Zurich America), (U.S. vs. "1,003.5 acres of land - Morris Deposit"). Have testified before the International Center for the Settlement of Investment Disputes (World Bank ICSID), in Crystallex vs. Venezuela. Have testified during other arbitrations including FL Smidth vs. Newmont Mining, Goldrich Mining vs. NyacAu, and Jacobs Peru vs. Chinalco - Toromocho as a minerals industry / mining / metallurgical expert. Recent projects include formal mineral estate appraisal of fair market value for properties containing uranium, iron, gold, silver and industrial minerals. Engineering services were provided to Tetra Tech for the Peace River – Tumbler Ridge Project. Contracted with Jacobs Engineers for the Climax Restart Project. A technical evaluation of sorting machines and operations was presented to BHP Billiton in Melbourne, Australia. NI 43-101 compliant reports were prepared for GlobeStar Mining-Cerro de Maimón Copper / Gold Project in the Dominican Republic; Gold Road Project in Oatman, Arizona; Nevada Copper Pumpkin Hollow in Yerington, Nevada; Tournigan Energy Kuriskova Project in Slovakia; Lion Copper and Gold MacArther Oxide Project in Yerington, Nevada. Other clients include TetraTech, Golden, Colorado; Charles Taylor and Associates Mexico City; Groupo Mexico, Cananea, Mexico; Cambior USA, Denver, Colorado, Kiewit Technology District - Level 3 Communications, and PPG Industries.

EXPERIENCE

Mt Hamilton Gold / Tungsten Project, Westmont Mining Corp., R. W. Jolk, P.E.
Englewood, Colorado; Ely, Nevada (May 1989 through August 1989)

Contracted as a metallurgical consultant to prepare preliminary design of Westmonts' Mt. Hamilton gold project process facilities using results from previously conducted metallurgical testwork as a basis for the engineering design parameters. Work included developing engineering design, feasibility and market study on the economics to recover tungsten from Mt. Hamilton.

Other Ventures in Engineering and Mine Equipment Support

Manager Western US, Nordberg Corp. Mining Equipment Sales and Support, R. W. Jolk, P.E.
Parker, Colorado (February 1998 through March 1999)

Responsible for the marketing and technical support of Nordberg mining / crushing equipment throughout the Western U.S. including Alaska. This included the evaluation of mining operations upon which recommendations concerning mine equipment, replacement parts, and wear materials were made to mine operators. Responsibilities also included supporting domestic and international projects being developed by Western U.S. engineering, procurement, construction and management (EPCM) firms.

Cost/Value Engineer, Martin Marietta Aerospace, Denver, Colorado.
Denver, Colorado; Baltimore, Maryland (August 1984 through March 1987)

Engineer in the Life Cycle Cost/Value Engineering group of the Logistics Department performing economic modeling for mining and earth systems involved in various DOD programs including Hard Mobile Launcher (HML), Kinetic Energy Weapon (KEW), National Aerospace Plane (NASP), and the Peace Keeper (MX missile) system. Inspection and analyses were performed on six decommissioned Minuteman III silos to determine the most inexpensive mining technique available to refurbish these silos for use with the MX system. Prepared plans to decontaminate, close, and recommission the wastewater treatment facilities and piping for the chemical milling sumps used in the production of Titan Missile booster rockets for the Facilities Department in Waterton, Colorado. Sumps contained residues from the chemical milling process (both acidic and caustic) and several additional waste streams that had been diverted to this facility over the years including monomethylhydrazine, TCE, and chromic acid.

Professional Engineer – Inspection Services, Stapleton International Airport Freight Facility, Isbill Engineers, Inc., Denver, Colorado.
Denver, Colorado (September 1983 through August 1984)

Professional engineer (PE) on site during the construction of the Stapleton International Airport - Freight Facility. Work entailed engineering inspection and sign-off of partial and complete civil, structural, mechanical, and hydraulic constructs as civil, mechanical, electrical, geotechnical and earthwork contractors completed them. Construction included placement of taxiway sub-grade and concrete, installation of rainwater drainage systems, driving of bridge pilings, and the placement of bridge and spillway foundations, walls, and capping.

Graduate Student - TA/RA, Colorado School of Mines, Golden, Colorado.
Golden, Colorado (September 1983 through August 1984)

In addition to carrying a full time load pursuing a Masters in Mining Engineering, worked 20 hours per week as a Teachers' Assistant in Mine Systems Analysis and Mine Valuation. Visited several oil shale and tar sands projects near Dinosaur, Colorado and Vernal, Utah, in order to investigate the possibility of using tunnel boring machines and in-situ retorting for low cost mine development and oil production.

COMMUNITY SERVICE

- Presentation to the 5th grade class of Northside Elementary, Montrose, CO, regarding the importance of the mineral industry and jobs associated therewith, November, 2016.
- Society of Mining Engineers, Professional Engineer Exam Committee, 2014 to present.
- American Institute of Mineral Appraisers, Chair of Valuation Session, Presenter, SME Annual Meeting, March 1st, 2011.
- Executive committee member of the SME Colorado Section Mineral Processing Division (MPD), 2004 and 2005.
- Served on GEM and Minerals Policy and Management Committees of the Society of Mining Engineers, February 1994 through February 1996.
- Industry contributor presenting before the National Academy of Sciences Committee on research funding for the U.S. Bureau of Mines; Salt Lake City, Utah; June 1994.
- Served on the Colorado Governor's Admissions Committee for the Hazardous Waste Management Program, Colorado School of Mines, spring, 1991 through fall, 1993.
- Commissioner on the City of Englewood, Planning and Zoning Board from 1987 to 1988.

PUBLICATIONS and PRESENTATIONS

- "Timberline Resources – Talapoosa Pre-Feasibility Study", NI 43-101 compliant report, SEDAR.com, MPDI for WSP Group, Inc., April, 2015; QP for metallurgy, process, economics.
- "What Gives Mineral Properties Value", a presentation to the American Institute of Mineral Appraisers, Society of Mining Engineers annual meeting, February 28th, 2014.
- "Quaterra Alaska – MacArthur Copper Project Pre-Feasibility Study", NI 43-101 compliant report, SEDAR.com, MPDI, Inc., March, 2012; QP for metallurgy, process, economics.
- "European Uranium Resources – Kuriskova Pre-Feasibility Study", NI 43-101 compliant report, SEDAR.com, TetraTech, Inc., March, 2012; QP for metallurgy, process, economics.
- "Automated Sorting of Mineral Deposits", a presentation at the Society of Mining Engineers annual meeting, February 21st, 2012.
- "Nevada Copper Corporation – Pumpkin Hollow Feasibility Study", NI 43-101 compliant report, SEDAR.com, TetraTech, Inc., February, 2012; QP for metallurgy, process, economics.
- "Contribution to Value – What Counts", a presentation to the American Institute of Mineral Appraisers, Society of Mining Engineers annual meeting, March 1st, 2011.
- Draft Revised United Nations Framework Classification for Fossil Energy and Mineral Resources 2008, United Nations (UNFC-2008); contributor.
- "Improved Heap Leach Extraction Through Selective Ore Placement and Targeted Leach Parameter Optimization", PhD Dissertation, Colorado School of Mines, Golden, Colorado, April 2007.
- "Cerro de Maimón Project Sensitivity Analysis", NI 43-101 compliant report, SEDAR.com, R. W. Jolk, P.E., July, 2006; overall QP.
- "Cerro de Maimón Project Feasibility Study", NI 43-101 compliant report, SEDAR.com, Behre Dolbear & Co., May 2005; overall QP.
- "Applying Environmental Tax Credits to Reduce Property Taxes", Randol Gold, September 1993.
- "Heap Detoxification at the Green Springs Project", Randol Gold Forum, October 1992.
- "A Review of Mineral Reserve Classification Systems", PPG Industries, May 1985.
- "Regrind and By Products Plant Operations Manuals", Climax Molybdenum Company, 2 & 9, 1981.